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(54) Abstract Title
Use of a fungicide on a plant into which has been introduced, by genetic modification, a trait conferring fungal resistance

(57) Fungi on a plant, its seed or other part thereof, wherein the plant contains a trait conferring fungal resistance, the trait having been introduced by genetic modification, can be better controlled by applying one or more fungicides to the plant. A synergistic effect is also often obtained.

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This invention relates to an improved fungicidal method.

- 5 Various plants have been described in which a one or more genes have been inserted to confer fungal resistance to the plant.

Examples of methods of transforming plants are disclosed in WO 92/17591, WO 90/07001, WO 95/14787, WO 94/1262 and WO 195/02319.

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A problem with plants resistant to fungal infections is that often the resistance is not high enough and/or is the resistance is limited to certain pathogens and/or pathogens overcome the resistance after a period of time and/or the anti-fungal effects might only come into play after the plants have been attacked and

- 15 somewhat damaged by the fungus.

We have now found that many of these disadvantages can be overcome by treating the transgenic plants with a conventional fungicide. A synergistic effect is also often obtained.

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Thus, according to the invention, there is provided a method of improved control of fungi on a plant, its seed or other part thereof, which plant contains a trait conferring fungal resistance, and which trait has been introduced by genetic modification, which comprises applying one or more fungicides to the plant.

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In a particular aspect of the invention there are provided seeds of such plants, which have been treated with a conventional fungicide.

- 30 The fungicides may be applied in any conventional manner used to apply fungicides to plants or their seeds or other parts including treatment of wood from transformed plants.

Examples of fungicides which can be used in this way are following:

- (i) a conazole sterol Δ^{14} -demethylase inhibitor.

- (ii) a sterol Δ^{14} -reductase/ $\Delta^{8,7}$ -isomerase reduction inhibitor based on a 1-[3-(4-tert-butylphenyl)-2-methylpropyl] group which is attached via the N-atom to piperidine or 2,6-dimethylmorpholine
- (iii) a dithiocarbamate fungicide
- 5 (iv) a phthalimide fungicide in which a chloroalkylthio group is attached via the N-atom to the optionally hydrogenated phthalimide group.
- (v) an anilide fungicide
- (vi) an mbc fungicide.
- (vii) a carbamate fungicide
- 10 (viii) a copper compound fungicide
- (ix) a tin compound fungicide
- (x) a strobilurin type fungicide,
- (xi) a 2-anilinopyrimidine fungicide
- (xii) a compound which causes systemic activated resistance, or
- 15 (xiii) a fungicide selected from the group consisting of chlorothalonil, dimethomorph, fenpiclonil, fluazinam, hymexazol, nuarimol, pencycuron, pyrifenoxy, thicyofen, probenazole, pyroquilon, tricyclazole, quaternary ammonium compounds, fludioxonil, quinoxifen, famoxadone, diclocymet, spiroxamine, flumetover, fenhexamid,
- 20 furametpyr, diflumetorim, fencaramid, carpropamid and sulfur.

Conazoles are defined in ISO standard 257 as compounds based on imidazole or 1,2,4-triazole and containing a halogenated phenyl group. Examples include

25 prochloraz (and its metal complexes - especially the zinc, manganese or copper complex), propiconazole, flusilazole, hexaconazole, tebuconazole, difenoconazole, bromuconazole, cyproconazole, diniconazole, fenbuconazole, imibenconazole, furconazole, tetraconazole, myclobutanil, penconazole, fluquinconazole, azaconazole, imazalil, triflumizole, epoxiconazole, triticonazole, metconazole and oxpoconazole.

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Examples of type (ii) fungicides include fenpropimorph and fenpropidin.

Examples of type (iii) fungicides include mancozeb and thiram.

35 Examples of type (iv) fungicides include folpet, captan and captan.

Examples of type (v) fungicides include

- a) 3',5'-dichloroanilide fungicides in which the anilino nitrogen comprises a ring carrying two oxo substituents, in positions adjacent the nitrogen, e.g. iprodione, vinclozolin or procymidone, or
- b) acetanilide fungicides, e.g. metalaxyl or ofurace,
- 5 c) sulfanilide fungicides, e.g. dichlofluanid,
- d) benzanilide fungicides, e.g. flutolanil, and
- e) heteroarylanilide fungicides, e.g. thifluzamide.

Examples of type (vi) fungicides include carbendazim, benomyl and thiophanate-methyl.

Examples of type (vii) fungicides include diethofencarb and propamocarb.

Examples of type (viii) fungicides include Bordeaux mixture, oxine-copper, copper oxychloride and copper naphthenate.

Examples of type (ix) fungicides include tributyltin oxide and tributyltin naphthenate.

Strobilurin type fungicides (type (x) fungicides) are methyl esters or N-methylamides of arylacetic acid in which the acetic acid also carries a methoxymethylene or methoxyimino substituent. The aryl group is usually a 2-substituted phenyl group and/or can be separated from the acetic acid by a linking group such as oxygen. Examples of such compounds are those disclosed in a wide number of patent applications, including EPs 178808, 178826, 203606, 203608, 206523, 212859, 226917, 229974, 242070, 242081, 243012, 243014, 243014, 244077, 251082, 253213, 254426, 256667, 260794, 260832, 267734, 270252, 273572, 274825, 278595, 280185, 280383, 291196, 307101, 307103, 310954, 312221, 312243, 329011, 331061, 331061, 331966, 335519, 337211, 341845, 342459, 348766, 350691, 354571, 363818, 370629, 373775, 374811, 378755, 379098, 382375, 383117, 384211, 385224, 385357, 386561, 386681, 387499, 389901, 393428, 393861, 398692, 400417, 402246, 405782, 407873, 407891, 414153, 420091, 422597, 426460, 429968, 430471, 432503, 433233, 433899, 438726, 439785, 459285, 460575, 463488, 463513, 464381, 468684, 468695, 468775, 471261, 471261, 472224, 472300, 473980, 474042, 475158, 477631, 480795, 483851, 483985, 487409, 489660, 498188, 498396, 499823, 503436, 508901, 509857, 513580, 525516, 528245, 528681, 531821, 532022, 532126, 532127, 534216.

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 97/06679, 97/06680, 97/06681, 97/06682, 97/06683, 97/06684, 97/07096, 97/07099,
 20 97/07103 and 97/11606.

Specific compounds are those having the having the common name kresoxim-methyl
 and azoxystrobin and the compound having the code number SSF 126, for which the
 common names, metominostrobin or fenominostrobin, have been proposed..

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Examples of type (xi) fungicides include pyrimethanil, mepanipyrim and cyprodinil.

An example of a type (xii) fungicide is that having the code number CGA 2425704,
 which is sold under the trade name "Bion" and whose proposed common name is
 30 acibenzolar.

The names quoted for these compounds are the non-proprietary common names and
 the chemical structure can be found for example by reference to the "Pesticide
 Manual", eleventh edition, 1997, published by the British Crop Protection Council. Of
 35 the compounds whose common names are not mentioned in the Pesticide Manual the
 full chemical names are as follows:

- oxpoconazole - bis[1-{2-[3-(4-chlorophenyl)propyl]-2,4,4-trimethyl-1,3-oxazolidin-3-ylcarbonyl}imidazolium]fumarate
- diclocymet - 2-cyano-N-[1-(2,4-dichlorophenyl)ethyl]-3,3-dimethylbutyramide
- spiroxamine - 8-*tert*-butyl-1,4-dioxaspiro[4,5]decan-2-ylmethyl(ethyl)(propyl)-amine
- 5 flumetover - 2-(3,4-dimethoxyphenyl)-N-ethyl- α,α,α -trifluoro-N-methyl-*p*-toluamide
- fenhexamid - N-(2,3-dichloro-4-hydroxyphenyl)-1-methylcyclohexane-carboxamide
- 10 furametpyr - 5-chloro-N-(1,3-dihydro-1,1,3-trimethylisobenzofuran-4-yl)-1,3-dimethylpyrazole-4-carboxamide
- fencaramid - isopropyl (1*S*)-2-methyl-1-[(*RS*)-1-tolylethylcarbamoyl]-propylcarbamate

- 15 As well as fungal resistance traits, the plants may also contain other traits introduced by genetic engineering, such as insect or herbicide resistance or traits which modify parts of the plants or its products, such as modified oils and starches.

CLAIM

- 1 A method of improved control of fungi on a plant, its seed or other part
thereof, which plant contains a trait conferring fungal resistance, and which trait
has been introduced by genetic modification, which comprises applying one or
5 more fungicides to the plant.



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Claims searched: 1

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Date of search: 2 June 1999

Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q):

Int Cl (Ed.6):

Other: Online: EPODOC, JAPIO, WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X,P	WO 98/49899 A1 (AGREVO UK) 12.11.98, see pages 1 (line 9ff), 4 (line 11ff) & 7 (lines 17-19)	1
X,P	WO 98/13478 A2 (MOGEN INTERNATIONAL) 02.04.98, see pages 1 (lines 9-11), 21 (lines 2-4 & 15-16), 23 (lines 33-34 & 37-38) & 24 (line 1)	1
X	WO 95/02319 A1 (SALK INSTITUTE FOR BIOLOGICAL STUDIES), see pages 5 (lines 1-5) & 24 (line 23ff): transgenic plants with fungal resistance; acknowledged in this application	1
X	WO 92/17591 A1 (DANISCO), see page 1 (lines 3-10): transgenic plants with fungal resistance; acknowledged in this application	1
X	WO 90/07001 A1 (E I DU PONT DE NEMOURS), see page 1 (lines 6-10): transgenic plants with fungal resistance; acknowledged in this application	1

X Document indicating lack of novelty or inventive step
Y Document indicating lack of inventive step if combined with one or more other documents of same category.

& Member of the same patent family

A Document indicating technological background and/or state of the art.
P Document published on or after the declared priority date but before the filing date of this invention.
E Patent document published on or after, but with priority date earlier than, the filing date of this application.